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ABSTRACT

Conducted as part of the longitudinal Vocational Development Study, this research applied Holland's personality theory to a sample of 138 Grade 11 male vocational students to determine their personality type and investigate the relationships between personality type and achievement. Personality types were related to several measures of achievement to see if greater achievement resulted when the student's personality type matched his educational environment. Some major findings were: (1) Of those students administered Holland's Vocational Preference Inventory, 57 percent were classified as Realistic personality types, 8 percent as Intellectual, 4 percent as Social, 9 percent as Conventional, 10 percent as Enterprising, and 12 percent as Artistic, (2) There does not appear to be a relationship between scores on each of Holland's six personality scales and school achievement, (3) Students whose personality type and training environment are congruent do not achieve higher grade point averages than those students whose personality type and training environment are incongruent, and (4) Congruent students do not exhibit higher levels of achievement than incongruent students when achievement is measured by the student's course grade only. (Author/SB)

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THE PENNSYLVANIA STATE UNIVERSITY
DEPARTMENT OF VOCATIONAL EDUCATION

RELATIONSHIPS BETWEEN HOLLAND'S VOCATIONAL PREFERENCE INVENTORY AND VOCATIONAL-TECHNICAL STUDENT ACHIEVEMENT

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Pennsylvania Department of Education
Bureau of Vocational, Technical and Continuing Education
Research Coordinating Unit
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Relationships Between Holland's Vocational Preference Inventory and Vocational-Technical Student Achievement

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The Pennsylvania State University

University Park, Pennsylvania

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PREFACE

The research reported in this monograph was conducted as a part of the longitudinal Vocational Development Study (VDS) which has been underway in the Department of Vocational Education at The Pennsylvania State University since the fall of 1968. The project was begun by the late Dr. Joseph T. Impellitteri and has been supported by research funds from the Pennsylvania Vocational Education Research Coordinating Unit (RCU). It is the objective of this project to undertake both basic and applied studies which have present and/or future implications for ongoing Vocational Education programs in the State of Pennsylvania as well as nationally.

This study conducted by Martin is focused primarily on basic questions dealing with affective characteristics of vocational students and their relationship to achievement in vocational-technical programs. Holland's Vocational Preference Inventory (VPI) has been used to assess the student's vocational personality while GPA, shop grade, and the Ohio Trade and Industrial Education Achievement test have been used to assess achievement. The exploration of Holland's theory with secondary vocational-technical students is seen as a major contribution of this research effort.

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VDS CAPSULE OF FINDINGS AND IMPLICATIONS

This research applied Holland's personality theory to a sample of vocational-technical high school students to determine their personality type and investigate the relationships between personality type and achievement. Personality types were related to several measures of achievement to see if greater achievement resulted when the student's personality type matched his educational environment. The major findings and implications drawn from this study are presented here.

Findings

1. Of the vocational students who were administered Holland's Vocational Preference Inventory (VPI), 57 percent were classified as Realistic personality types. The remaining personality types were found to be present in the following percentages: Intellectual, 8 percent; Social, 4 percent; Conventional, 9 percent; Enterprising, 10 percent; and Artistic, 12 percent.

2. Overall, there does not appear to be a relationship between scores on each of Holland's six personality scales and school achievement for vocational technical students.

3. Vocational-technical students whose personality type and the environmental type of their training surroundings match (i.e., are congruent) do not achieve higher grade point averages than those students whose personality type and training environment do not match (i.e., are incongruent).

4. The data indicate that congruent (i.e., Realistic) vocational-technical students do not exhibit higher levels of achievement than

incongruent students when achievement is measured by the student's course grade only.

5. When the Ohio Trade and Industrial Education Achievement Tests rather than shop grade were used to assess shop achievement congruent (i.e., Realistic) vocational-technical students again did no better than incongruent vocational-technical students.

Implications

1. Holland's hypothesis that people tend to select an environment consistent with their personality type is somewhat supported by the findings of this study. Therefore, the assessment of both students and shop environments using the Vocational Preference Inventory (VPI) could contribute to the shop selection process.

2. The assumption that all vocational-technical shops provide Realistic environments is questionable. An empirical assessment of the many kinds of vocational-technical shop environments would be beneficial to school personnel and students alike.

3. Although the use of three different kinds of in-school achievement criteria failed to produce a relationship between personality type and achievement, it cannot be assumed that personality type and success of other kinds or success at a later date is unrelated to personality type.

4. Although there are many ways presently used to group vocational-technical learning activities together, the possibility of clusters based on work environments is suggested by this study.

I

ORIGIN OF THE STUDY

Introduction

All fields of education, both in this country and others, are currently facing innumerable problems. In the United States these problems range from contention over student dress code to the current battle over bussing of school children to achieve racial balance. Many of these problems, while urgent today, will most likely be alleviated or solved in the near future and eventually forgotten. While many of our nation's educational problems are of this nature, some of the crucial ones are not. These are the problems which have to be solved every day and every year that formal education continues to exist. One problem of this nature is concerned with the economics of education. What should be the nation's monetary investment in education? How much should be invested in specific educational programs? Is current spending in education economical? Is it efficient?

Nowhere in education has this problem become more critical than in vocational and practical arts education. In virtually every case, the cost of educating a student vocationally far exceeds the cost of a comparable general or academic education; for two major cities the 1960 cost differential per student amounted to $116 and $154 respectively and has undoubtably risen since (Stromsdorfer, Hu, and Lee, 1971). If monetary costs alone were the determining factor, cities as these would be encouraged to discontinue vocational-technical education programs. The "extra cost" factor of vocational education has convinced many citizens and educators that the schools cannot afford the added expense

of the vocational program; many others, however, feel that the benefits are more than justifiable. For a true picture, measurement must be made not only in terms of costs and benefits to the student and school, but also to society. Early research investigating the cost and benefits of vocational education found the investments high and the benefits low (Corazzini, 1966; Kotz, 1967; Taussig, 1968). Other cost-benefit analyses have reached the opposite conclusion that vocational-technical education is an economically worthwhile investment and worthy of extra public funds to support it (Hu, et al., 1969, 1971; Kaufman, 1967, 1968; Kaufman, Hu, Lee, and Stromsdorfer, 1968; Kraft, 1969).

Kaufman has noted that the value of cost-benefit analysis lies not in establishing a "least-cost" method, but in determining the most efficient means of obtaining an objective. O'Donoghue, an Irish educator, has explored the economic dimensions of education with in-depth examinations of demand, social investment, efficiency, and financing. Though cost-benefit analysis provides much useful information, O'Donoghue (1971) makes it clear "...that assessments of efficiency in education cannot be made solely on the basis of cost data but must also take account of the relevant output objectives." It becomes clear that if investment in vocational education is to be defensible, a great deal of effort needs to be placed in (1) stipulating distinct, measurable output objectives, and (2) finding the most efficient methods of reaching them.

Of the two issues, specifying output objectives and identifying efficient methods, efficiency will be discussed first since it should be of some benefit in understanding where and how output objectives fit into vocational-technical education. Efficiency can be increased in vocational education in various ways, from better use of materials to

improving the curriculum, from increasing teacher preparation to improving student attitude, or simply by reducing student absences. No one way should be chosen, but all should be explored in an effort to increase efficiency. How efficient vocational education becomes is also dependent upon what vocational theorists hypothesize and find to be true in the vocational world. Of hopeful vocational theorists there are many, of hopeful theories there are a few, of adequately efficient theories there are none. Though partial solutions are possible through improved teaching methods and greater use of learning theories, a substantial problem to be solved is the proper selection of a curriculum for each student in a vocational-technical training program. Can vocational development theory supply any answers?

Obviously, a person will not be well prepared if he wishes to be a machinist and graduates from a carpentry shop, or sees himself as a potential draftsman and completes a business education program. Although problems of this nature can be alleviated by vocational counselors, what efficiency is illustrated in the case of a high school student who wanted to be a draftsman, completed an appropriate program, graduated, took a job as an apprentice draftsman, and quit in six months to become a furniture salesman? The case is an example of perhaps the largest single loss in efficiency, i.e., the non-use of the technical education training. Could a vocational counselor have forecast or prevented this loss in efficiency? Was it lack of vocational information or lack of vocational experience? Much has been done to increase the information available to the student; and many educators would like to increase vocational experience, although constraints of time and resources severely limit their ability to do this.

A theory of vocational choice has been proposed and tested by Holland (1959) which may provide direction for the student and efficiency for the educational system. To illustrate Holland's theory in the case of the draftsman turned salesman, the explanation possibly lies in the student's compatibility with a sales environment; his personality was similar to that of other salesmen, and the sales atmosphere met his needs. This condition, in Holland's farmework, is termed congruence. Because his personality differed from other draftsmen's and the draftsman's environment did not meet his psychological needs, the student was incongruent with his original occupational choice. Had the counselor recognized the personality characteristics of the student and had he seen the differences in occupational environments, he would have been able to predict the results and possibly improved the efficiency of the outcome, that is, facilitated a transfer of the student to an appropriate business curriculum where his education would benefit his occupational choice to a much greater degree. The student, if he understood his type of personality and the types of occupational environments, would be in a more knowledgeable position to make a vocational choice. According to Holland (1966b), these person-environment interactions are instrumental in vocational behavior and vocational outcomes such as vocational choice, vocational satisfaction and vocational achievement.

In the effort toward efficiency in education, Holland's framework holds promise in the area of student self-understanding, enabling greater self-realization, and as a theory vocational counselors can work with in concrete terms. That counselors could use this help is pointed out by many. Lofquist and Dawis (1969) make mention of a need for a supporting framework with which vocational counselors can operate.

Individuals need to be described in work relevant terms and need to relate their individual characteristics to occupational environments in a systematic way. Vocational counselors must be provided with techniques that enable them to make predictions concerning such matters as occupational success, job satisfaction and work adjustment. Vroom (1964) emphasizes the need for understanding the occupational choice process, arguing that an empirical approach, as Holland's approach, is necessary for a sound conceptual base in vocational guidance.

Previous mention has been made to outcomes, or output objectives, in relation to efficiency. Whether or not a vocational choice framework such as Holland's has any merit can best be determined by using it as a predictor of vocational outcomes. If the theory is to be useful, congruence and incongruence must bear significantly on the factors of vocational choice, vocational satisfaction, and vocational achievement. Each factor takes meaning when a student actually enters a work environment; and, even then, some period of time must elapse before a reasonable estimate of vocational satisfaction or vocational achievement can be measured. Of these latter two variables (vocational achievement and vocational satisfaction), only vocational achievement appears to lend itself to objective, quantifiable analysis at the present time. It would appear then that output objectives, couched in terms of vocational achievement, would provide the best criteria to test the concept of congruence-incongruence. While vocational achievement in the occupational environment may be determined by factors such as salary, performance, and retention, other criteria must be applied in a training environment. Rating systems or performance tests are possible criteria for vocational students, but currently it is the grade point average (GPA)

that is the standard of achievement. Education, in providing these standards, developed a system which has evolved over many years and has been accepted by both education and society as valid criteria to measure student success. In vocational education, the criteria of vocational-technical course grades may be different, and more relevant to occupational success than would the more general criteria of overall grade point average (GPA). Shop grades, because they deal only with achievement directly related to a trade area, might then be more useful.

Kapes and Long (1971), however, have found evidence that shop grades contain a large component which is not related to knowledge of the subject matter in a trade area. If this is the case, then a specific measure of vocational achievement, competency in the chosen trade, could well be the best criterion of vocational training success. Increased interest in program evaluation in vocational-technical programs has led to the development of one such specific measure of achievement: The Ohio Trade and Industrial Education Achievement Tests (OTAT). Under the assumption that occupational satisfaction and achievement later in life are closely related to knowledge of the specific trade, the OTAT would then be justified as criteria for use in testing a congruence-incongruence theory.

Because the Kapes and Long findings support the validity of the OTAT as an efficient means of determining the knowledge achievement in a trade area and because of its potential, the OTAT has been used as a criterion measure in this study.

When investigating congruence-incongruence and their relationship to achievement, personality and environmental type must be accurately determined to identify whether a student is congruent or incongruent with

his environment. Holland's Vocational Preference Inventory (Sixth Revision, 1965) was developed as a technique to identify the major personality style of an individual. Evidence supporting the VPI as a personality assessment instrument has been conducted by Holland (1966a, 1966b). According to Holland, environmental type is reflected by the people found in an environment. The present study determined environmental type by assessing both the occupation for which a student was being prepared and the educational environment in which he was preparing. Using this assessment for environmental type and the VPI scales for personality type, vocational-technical student congruence was determined.

Statement of the Problem

This study was concerned with efficiency gain through the application of a portion of Holland's theory. From Holland's hypothesis (1966b) that vocational achievement is a function of the interaction of personality and environmental types, this research attempted to support the position that congruency of vocational-technical students leads to increased achievement. For the purpose of this study, the vocational-technical environment was assumed to be Realistic. Formally stated, the research questions are as follows:

1. What proportion of vocational-technical students are congruent with their training environment (i.e., Realistic)?
2. What is the relationship between students' scores on each of the VPI scales and each of the three dependent variables, GPA, shop grade, and OTAT score?

3. Does congruence between personality type and environmental type result in greater achievement of vocational-technical students as measured by grade point average (GPA)?
4. Does congruence between personality type and environmental type result in greater achievement of vocational-technical students as measured by shop grades?
5. Does congruence between personality type and environmental type result in greater achievement of vocational-technical students as measured by the Ohio Trade and Industrial Education Achievement Tests (OTAT)?

Definition of Terms

Congruence-Incongruence: is of central importance to this study. These terms refer to the interaction between primary personality types and environmental types. A congruent interaction is one where a person's primary personality type is of the same type as the environment he inhabits, while an incongruent interaction is the result of differing primary personality types and environmental types.

Consistency-Inconsistency: while not essential in this study is an important part of Holland's framework. Consistent relations are assumed to result in favorable vocational outcomes while inconsistent relationships do not. Consistency exists when primary and secondary personality types are compatible with each other or when environmental primary and secondary types are compatible with each other.

Environmental Type: Astin and Holland have determined that an environment reflects the people found in it; therefore, environmental type refers to the major personality type found in an environment. For

this study the vocational-technical school environment is assumed to be realistic.

High Point Code: is the name given the highest VPI personality score when plotted on a normalized scale. For vocational students the realistic personality type was expected to occur as the high point code most frequently.

Homogeneity-Heterogeneity: refers to the magnitude of difference between the highest and lowest scores of the six scales on the VPI profile; the greater the magnitude of difference, the greater the homogeneity; conversely, the less the difference between the highest and lowest score, the greater the heterogeneity.

Output Objectives: the desired outcomes or goals of an educational program may be termed output objectives. They are the end products against which achievement must ultimately be measured.

Personality Type: Holland has defined six personality types (Realistic, Intellectual, Social, Conventional, Enterprising and Artistic) by which people may be classified. Holland (1966b, p. 10) states:

> Each type is the product of a characteristic interaction between a particular heredity and a variety of cultural and personal forces, including peers, parents, other significant adults, social class, culture, and the physical environment.

Depending upon his personality type, a person will exhibit different ways of coping with his environment. An individual's personality type may be assessed by using the high point code as measured by the VPI.

II

REVIEW OF RELATED LITERATURE

Introduction

A search of the literature was conducted to identify previous work in areas related to this study. The material reviewed has been placed in the following three categories:

1. Holland's theoretical framework.
2. Studies concerning Holland's framework and the VPI.
3. Studies of success criteria which relate to the present study.

The material found in these three categories is not all inclusive but is an attempt to extract and synthesize the most important and relevant information.

Holland's Theoretical Framework

To give a background to the reader who might be unfamiliar with Holland's career development theory, this review is included. This summary should also demonstrate the significance of Holland's theory to the conceptualization of this study. For a more complete account, one may read the original statement of the theory (Holland, 1959) and the more recent revision (Holland, 1966b). A useful review and critique of the theory has been prepared by Osipow (1968). Holland's original statement of a vocational development theory (1959) proposed a systematic method of classifying people by their personality as expressed through vocational preferences. The theory proposed that six model personality types and six model environmental types exist within which any person or environment may be classified. This early theory dealt mainly with the

choice process and only slightly with the outcomes. This theory was described by Holland as "a heuristic theory of personality types and environmental situations" meaning that the theory was intended to stimulate investigation of the personality and environmental types. From the investigations stimulated by the original theory has come a revised statement of the theory, more systematic and comprehensive, but fundamentally unchanged. The recent revision (1966b) goes beyond vocational choice to offer an explanation of vocational behavior based on person-environment interactions.

Holland's theory is founded upon several assumptions which provide a background for the theory. Generally, these assumptions come from what has been learned about people through the use of vocational interest inventories and personality inventories. Briefly stated, these assumptions are:

> The choice of a vocation is an expression of personality...Interest inventories are personality inventories...Vocational stereotypes have reliable and important psychological and sociological meanings...The members of a vocation have similar personalities and similar histories of personal development...Because people in a vocational group have similar personalities, they will respond to many situations and problems in similar ways, and they will create characteristic interpersonal environments...Vocational satisfaction, stability, and achievement depend on the congruency between one's personality and the environment (composed largely of other people) in which one works...Our knowledge of vocational life is disorganized and often isolated from the main body of psychological and sociological knowledge (Holland, 1966b, pp. 2-7).

The following four paragraphs describe the working assumptions which constitute the heart of the theory.

1. First, "in our culture, most persons can be categorized as one of six types--Realistic, Intellectual (Investigative), Social, Conventional,

Enterprising and Artistic" (Holland, 1966b). Each type is determined by the characteristics of people in an occupational group. The occupation of a person (consequently, his type) is the product of an interaction between heredity and a number of cultural and personal forces. These forces cause different personality types to deal with their environment in predisposed ways. It cannot be assumed that every person's attributes resemble only one of the six types, but the one type he most resembles will determine his major "personality type." His similarity to this type, as well as his similarity or dissimilarity to the other five types, constitute a personality pattern. By means of historical data, interviews, and assessment inventories, a personality pattern or "profile" is determined. This profile may then be used singly or in conjunction with environmental types to provide useful interpretation.

2. The second major assumption of Holland's theory is that there are six kinds of environments: Realistic, Intellectual (Investigative), Social, Conventional, Enterprising, and Artistic. The environments are identified by the people found in them and the special roles and physical conditions required in that environment. When people inhabit an environment, the environmental type will be reflected by the personality types of those people and may be assessed in the same manner that individual personality types are assessed. A Realistic environment, to take an example, would be produced when the majority of people who are in an environment have strong Realistic personality profiles and when the tasks and demands found in the environment are complimentary to Realistic personalities. For a Realistic environment these tasks would be physical, concrete, and demanding of mechanical skill. Interpersonal skills would be at a minimum.

3. Holland's third assumption is that people will seek occupations and environments which are compatible with their personality. People desire tasks which are agreeable with their abilities and skills and try to avoid disagreeable ones. Consequently, Realistic types search for Realistic environments, Social types seek Social environments, and so forth. An individual searches for a compatible environment in many ways over a long period of time. From childhood to adulthood he searches, seeking knowledge about himself and environments. Often he is unconscious that this investigation is taking place. It proceeds naturally as a part of human maturation.

4. The last assumption of the theory is that a person's behavior can be explained by his personality type and the interaction of personality type and environmental type. Some of the outcomes which can be deduced from the pairing of personality pattern and environment include choice of a vocation or training program, level of achievement, stability and occupational mobility. Each personal outcome is affected by a person's personality type, by the type environment he is in, and by the interaction of these two. A Realistic person, because of his type, will exhibit characteristic coping behaviors. Placed in a Realistic environment he can be expected to handle the tasks and show a higher level of achievement than if placed in a different environment.

The assumptions described above constitute the core of Holland's theory. Research which indicates the validity of these assumptions has led Holland to several hypotheses about personality profiles, environmental patterns, and the outcomes of pairing persons and environments. One hypothesis concerns consistent-inconsistent codes. Holland's typology is based on the fact that each personality or environmental

pattern is made up of the six types--R, I, S, C, E, A--each to a different degree. The personality type or environmental type which is most dominant is termed the "primary" type, the next most dominant is the "secondary" type, and so forth. Through empirical study, Holland discovered that certain combinations of primary and secondary types had more favorable outcomes. Any particular type exhibits characteristics similar to some of the types and dissimilar to others. Similar types are compatible combinations and when a primary and secondary type are compatible, they are said to be "consistent." If the primary and secondary type are dissimilar, they are incompatible and termed "inconsistent." The consistent and inconsistent primary-secondary combinations are shown in Figure 1.

	Secondary					
Primary	R	I	S	C	E	A
Realistic	-	C	I	C	I	I
Intellectual	C	-	I	I	I	C
Social	I	I	-	C	C	C
Conventional	C	I	C	-	C	I
Enterprising	I	I	C	C	-	C
Artistic	I	C	C	I	C	-

Figure 1. Consistent and Inconsistent Codes (Holland, 1966b, p. 44). Note: C = Consistent, I = Inconsistent.

Another factor developed from the theory determines the extent to which the primary type exceeds the other six profile types. The magnitude of the difference between the highest and lowest is termed homogeneity. The greater the difference between the highest and lowest types, the greater the homogeneity; conversely, the less difference between the highest and lowest, the more heterogeneous the pattern. Homogeneity is positively correlated with, but not identical to,

consistency. While consistency refers to the structure of the environment or personality, homogeneity is a measure of degree. One effect of highly homogeneous environments or personalities is vocational stability.

Congruent person-environment interactions also contribute to vocational stability. "Congruency" is termed the interaction of people and environments belonging to the same type or model. An automobile mechanic (Realistic type) working in a major company's fleet operation (Realistic environment) is termed congruent. That same mechanic if transferred to a sales position (Enterprising environment) in the company would then be termed incongruent. The Realistic mechanic would be even more uncomfortable (and less congruent) if placed in the company's product design department (Artistic environment). Congruence between personality type and environmental type may vary as demonstrated by Figure 2, where the appeals of each model environment are shown for each personality type.

	Model Environments					
Personality Types	Real.	Intel.	Soc.	Conv.	Ent.	Art.
Realistic	++	+	-	-	-	--
Intellectual	+	++	-	-	--	+
Social	--	-	++	-	+	+
Conventional	-	-	+	++	+	--
Enterprising	-	--	+	-	++	+
Artistic	-	-	+	--	-	++

Note: ++ Equals "very attractive"
+ Equals "attractive"
- Equals "unattractive"
-- Equals "very unattractive"

Figure 2. The Attractiveness of the Model Environments to Different Personality Types.

As mentioned, congruency contributes to stable vocational choice. It also contributes to higher vocational achievement, higher academic achievement, better maintenance of personal stability, and greater satisfaction.

Taken together, it is assumed that different combinations of congruency, consistency, and homogeneity result in different kinds and degrees of outcomes. The congruent interaction of a consistent and homogenous personality with a consistent and homogenous environment will result in a more predictable and vocationally desired outcome than an incongruent interaction or an interaction where either personality or environment is inconsistent or heterogeneous.

Holland has extended the environmental outcomes of person-environment interactions by applying the typologies over long periods of time. Using the personality types and environmental models, a "life history" examination can be made of a person's development. Though little research has been conducted in relation to life history, Holland suggests a longitudinal model which may determine the conditions that lead to stable or unstable patterns. The longitudinal model provides a method of coding change of occupational choice which weights the changes. Both intraclass and interclass changes are recorded and analyzed in light of the six theoretical types--Realistic, Intellectual, Social, Conventional, Enterprising, and Artistic.

Summary

Holland's theory proposes six model personality types. By applying the Vocational Preference Inventory, a personality profile may be determined for an individual resembling in varying degrees each

personality type. Coinciding with the personality types, the theory suggests six model environmental types which may be characterized by the vocation, training program and personality type prominent in the environment.

Interactions between similar personality type and environmental type are termed congruent by the theory and are expected to result in more favorable outcomes in the areas of satisfaction, vocational achievement, academic achievement and stability of vocational choice. The concepts of consistency and homogeneity, while included in this review, are not central to this study.

Studies Concerning Holland's Framework and the VPI

Many studies have investigated the validity of the Vocational Preference Inventory (VPI), and several studies have tested portions of Holland's theory of vocational choice; but until recently, most of the research generated has been by Holland or his associates. Since 1966, others have made use of or tested Holland's theory (Morrow, 1971; Scott, 1968; Werner, 1971; Olson, 1971; Ashby, Osipow and Wall, 1966, 1967).

The Holland theory originated in work by Holland and others (Holland, Krause, Nixon and Trembath, 1953). As a result of this work, his concepts of personality models and environmental models evolved. The Vocational Preference Inventory was developed from research relating occupational titles to personality characteristics (Holland, 1958).

Holland (1959) in "A Theory of Vocational Choice" proposed an apriori occupational classification of six categories--Motoric, Intellectual, Supportive, Confirming, Persuasive, and Esthetic. Between 1959 and 1965, Holland and his associates published a number of reports which

used the classification system to study the relationships of personality and environmental types to behavioral outcomes (Astin, 1961, 1963; Holland, 1962, 1963, 1964; Schutz, 1961; Stockin, 1964). While these studies used the classification system, they neither directly tested its value as a classification system nor explicitly defined it; testing and defining came later as a result of Holland's 1966 studies.

The pre-1966 studies demonstrated the construct validity of the VPI and the personality models. Holland used the VPI in these studies to assign to subjects personal orientations which served as independent variables. Generally, the VPI was scored on the six personality scales, with the highest scale score (the high point code) determining the appropriate personality type for the subject. A major criticism of these early studies is the fact that a highly homogenous population (National Merit Scholars) was used. Furthermore, the theory was based chiefly on studies of males and has not been applicable to females.

The follow-up studies of National Merit Scholars were presented in "Some Explorations of a Theory of Vocational Choice: I. One- and Two-Year Longitudinal Studies," (Holland, 1962). Personality types determined by the VPI were compared with personal information for each student. The occupational choices of the Merit Scholars were significantly related to their VPI personality types.

A four-year follow-up of 592 National Merit Finalists (Holland, 1963) again found the directions of occupational choice significantly related to appropriate personality types. In this study, the types were determined from scales on the Strong Vocational Interest Blank (SVIB) which were thought to be highly related to the VPI scales.

Scott (1968), in a review, noted that Holland's study also showed congruency of college environment to be positively related to stability, and in some cases, to achievement. Congruence between student and college also appeared conducive to achievement and conducive to stability in major field and career choice. Institutions where student change in field occurred more often were characterized as heterogeneous and inconsistent. Those students who changed their field of study most often moved toward congruent fields of study.

Another study (Holland and Nichols, 1964), again using National Merit Finalists, further supported the hypothesis that college students do tend to move toward major fields in which they are more similar with the typical student in terms of achievement, aptitudes, interests, and personal traits. They tend to move away from dissimilar fields.

Holland (1963-64, 1964) completed two studies dealing with vocational stereotypes and theoretical model types. The findings demonstrated that subjects tend to view occupations in stereotyped ways and that those stereotypes are consistent with the theoretical models.

Under the assumption that occupational titles could be assigned to one of the six types, the VPI was administered to students planning various occupations. The score averages were found and ranked for each occupation and the results used to define each occupation's place in the classification. This procedure applied to over 12,000 college freshmen (Abe, Holland, Lutz and Richards, 1965) produced empirical occupational classifications for both men and women; Abe and Holland (1965) found that of college freshmen planning to major in different fields, the Realistic types expressed preferences for technical and skilled trades, the Intellectual for scientific occupations, Social for teaching and

helping occupations, Conventional for clerical occupations, Enterprising for supervisory and sales occupations, and the Artistic types expressed preferences for artistic, musical, and literary occupations. In a second descriptive study of college freshmen (Abe and Holland, 19[illegible], when vocational choice was considered rather than major field of study, strong similarities were found. It was noted that though the choice of a major field may not be identical with the choice of a vocation, the results strongly suggest a close association. Generally, the descriptions of students seeking different vocations were consistent with related studies by Cooley (1963), Darley and Hagenah (1955), Davis (1964), Holland (1963) and Roe (1956).

Using the results of the 1965 studies, Holland (1966a) tested the value of the classification system directly. He found that students who chose occupations previously classed as Realistic by the theory's conceptual definition, had the highest mean score on the Realistic scale of the VPI; their mean scores were higher than any other group. Similar results were found for the other groups thus lending empirical support to the theory's conceptual definitions.

In another study, Holland (1968b) demonstrated that individual VPI profiles could be interpreted according to his theory of personality types; e.g., technical and mechanical competencies were associated with the VPI Realistic scale when it was the student's high point code.

A previous study by Holland and Lutz (1968) examined the predictive validity of a student's expressed vocational choice compared with the predictive validity of his scores on the VPI, using data collected by two American college surveys. The students were polled for their vocational choices which were categorized according to the VPI scales. They were

polled again either eight months or a year later. The results indicated that the process of asking college students about their choices is almost twice as efficient as the VPI in predicting vocational choice. For Realistic types, the prediction of final choice from first vocational choice was 67.9% correct, while for student's choice of vocation predicted from VPI scores, predictions were only 37.4% correct. The question was raised whether similar results would be obtained over longer periods of time or with different age groups.

An extension of the study (Holland and Whitney, 1968) investigated the hypothesis that occupational choices follow orderly patterns and can be predicted from initial choices. It was learned that by using the Holland classification scheme, a practical definition of occupational relatedness could be provided. The study found that the use of a three digit VPI code improved prediction over using only the highest VPI code.

As a result of early studies, the question had been raised concerning the independence of the six VPI scales. Osipow (1968) suggested that there was a basis for grouping the Realistic and Intellectual students together; the Social, Enterprising and Conventional as a second group; and the Artistic type by itself. Richards (in Holland, 1968a) performed a factor analysis to determine the degree of independence of each VPI scale. His results disclosed that each scale does measure something different from the others. He concluded that there are at least six kinds of people--there may be more, but not fewer.

At the same time the VPI was being validated and refined to identify personality types, another device was being constructed and tested to identify environmental types. Astin (Astin and Holland, 1961) reviewed the concept of environmental press (Pace and Stern, 1958) and noted their

development of a College Characteristics Index (CCI). The CCI identified characteristics of the student body, faculty and administration of a college. Astin based his Environmental Assessment Technique (EAT) on this notion and others, observing that a major portion of environmental forces are transmitted through people. Astin inferred that the character of a social environment was dependent upon the nature of its members. The dominant features of an environment are dependent upon the typical characteristics of its members. Knowing the character of the people tells the climate of the group. The EAT was designed with eight variables: (1) school size, (2) student intelligence level, (3) Realistic orientation, (4) Intellectual orientation, (5) Social orientation, (6) Conventional orientation, (7) Empirical orientation, and (8) Artistic orientation.

Astin tested the EAT with the CCI variables. The correlations implied compatability with the Holland typology. The CCI variables most closely related to the Realistic orientation were Humanism (-.81), Pragmatism (.73), and Reflectiveness (-.62); implying a preference for the practical and an aversion to feeling experiences. Subsequent research (Astin, 1962, 1963, 1965; Holland, 1963, 1968) has further substantiated the reliability and validity of the EAT.

Since the 1966 revision of the theory, some of Holland's research has dealt with the further extention of his classification system. A 1969 study (Holland, Whitney, Cole and Richards) attributed the following desirable characteristics to the revised theory:

a) explicit theory for interpreting class membership for organizing information about occupations and for revising the classification

b) mutually exclusive classes

c) efficient forecasting ability for several purposes

d) provision for extension to unclassified occupations by the application of a single empirical technique (Holland, et al., 1969)

In "A Psychological Classification of Occupations" (Holland, et al., 1970), 431 common occupations which comprise about 95% of the United States Labor Force were classified according to the theory of personality types. In each of the classification's main classes (R, I, S, C, E, A) were five to fifteen subclasses, such as Realistic-Intellectual-Artistic (R-I-A), Realistic-Intellectual-Social (R-I-S), etc. Vierstein (1971) extended Holland's occupational classification to all occupations listed in the Dictionary of Occupational Titles using two methods. One method was essentially an application of Bayesian statistics, while the second method used DOT definitions and assigned the appropriate Holland code.

Several other research efforts have been generated by the Holland theory. At The Pennsylvania State University, Scott (1968) tested three hypotheses of the Holland theory of vocational choice in relation to college placement and employee selection. For a small group of college interns, no significant relationship was found between person-environment interactions and vocational satisfaction, job satisfaction, job achievement, or stability of vocational choice. The lack of significant relationships could possibly be explained by the large number of female interns to which Holland's theory may not be applicable.

Olson (1971) examined postsecondary technology instructors in Pennsylvania to identify predictors of vocational stability and job satisfaction. The study was unable to show any statistically unique information about vocational stability or job satisfaction using the VPI scales.

In contrast, other recent studies have shown some support for Holland's theory. Morrow (1971) tested the effectiveness of Holland's theory of vocational choice for predicting students' satisfactions with their choices of college majors. Of two groups, satisfaction with major was related for mathematics students but not for sociology students. Another partial validation of Holland's theory of vocational choice (Patterson, et al., 1971) reported that occupational therapists corresponded to the Social personality type. The one study uncovered, which dealt with high school vocational students (Werner, 1971), supported the use of Holland's theory with a group of this type. The study examined the applicability of Holland's theory of vocational choice to high school students enrolled in vocational programs. This was done by investigating the relationship between the students' personality types and model environments and by testing for the existence of homogeneity, consistency and congruency. The concept of role choice was also investigated. The students chosen to participate were enrolled in six occupational areas--Auto Mechanics, Technical Electronics, Practical Nursing, Data Processing, Distributive Education and Commercial Art--representing each of the six Holland classifications, Realistic, Intellectual, Social, Conventional, Enterprising and Artistic.

The study found that students with a clear role choice did not achieve more than students undecided about a job role. However, the factor of role choice did show a marked effect on a student's satisfaction with his training program and whether or not he remained in his training program. This is in agreement with Holland's (1967) study which recommended that counselors listen to what students say they want to do.

For the congruent student whose personality type matched the training environment, these findings were noted:

> Congruent students, in general, had significantly higher mean achievement than incongruent students. Whether or not a student was congruent did not have a significant effect on the mean satisfaction scores of the total sample, although congruent boys had significantly higher mean satisfaction scores than incongruent boys.
>
> Congruence had a marked affect on attrition rate. All of the groups tested showed significantly lower attrition rates for congruent students than for incongruent students. This supports Holland's theory in that congruent students can be expected to remain in their training program at a significantly higher rate than incongruent students.
>
> These results suggest that if a person's highest score on an interest test such as the VPI is in the same classification or occupational area as his training program or his job, he could be expected to show greater achievement than if the test score and job did not agree. If the test score and job or training agree, a person will be more apt to finish the training program or remain in the job for a longer period of time than a person whose tested interests differ from his occupational classification (Werner, 1971).

The Werner study found that the factor of homogeneity did not significantly affect the total group on satisfaction scores and produced contradictory evidence on male and female achievement scores. Homogeneous girls had higher achievement scores than heterogeneous girls while heterogeneous boys had significantly higher achievement scores than homogeneous boys. In relation to consistent-inconsistent students, consistency appeared to have an adverse effect on mean achievement scores.

The study indicated that Holland's theory has relevance, but that more research is needed. Congruency, consistency and homogeneity, as derived from the VPI, were not found to have a clear affect on satisfaction and achievement scores, although they were shown to be additive

in the case of achievement prediction.

Summary

The studies reviewed here show strong support for the Holland typologies of personality type and environmental type. There does seem to be at least six different personality types which can be used to classify people. The validity studies of the classification system have supported the framework, suggesting that it may be useful to vocational educators and counselors in conceptualizing student personality.

The VPI has been validated as an instrument which determines a personality profile. The VPI has predictive validity in determining occupational choice but is only about half as effective as a student's expressed choice over a short period of time. The VPI's major contribution is in determining personality types and assessing congruence, consistency and homogeneity. Research has not conclusively resolved the validity of these latter three concepts in predicting occupational outcomes. Of the three, congruency appears the most valid predictor of achievement when dealing with high school vocational students.

Studies of Success Criteria Which Relate to the Present Study

In a report by Prediger, Waple and Nusbaum (1968), 38 studies to uncover valid predictors of success were reviewed. Of use to this study were the findings in regard to criteria. "Within a given vocational area, the criterion of success used whenever available was grade point average in the student's vocational courses. Inadequate as it may be, this was the most common criteria employed..." Obviously, the availability of grade point average and shop grade have caused them to be chosen as criteria for many of the studies reviewed, however, one would

also expect there to be a high degree of validity for these measures as predictors of occupational success.

Much research concerning these variables has, however, led to some other conclusions. Hoyt (1965) suggested that vocational educators, counselors and students be aware that academic success represents only one type of accomplishment. He indicated that the relationship of college grades to measures of adult success indicates that either the two are unrelated or, at best, moderately correlated. Hoyt arrived at these conclusions after reviewing 46 studies involving relationships between grades and later vocational success.

Pemberton (1970) has stated that it would be neither fair nor accurate to infer from Hoyt's study that grades mean nothing. By school graduation time, students are highly selected for ability. The positive relationships which might exist between grades and success are obscured by throwing together various course grades which represent different kinds and levels of achievement that aren't really compatible. Krathwohl (1952) has supported this view. He pointed to the low intercorrelations among grades in different subjects. A student may perform well in one area while doing poorly in others. If grades are to be used as the standard of success, they must be correlated with something besides the ability to make grades. Additional objective judgement, external to the grade making situation, must be provided if course evaluation is to be useful (Pemberton, 1970).

Moss and Stromsdorfer (1970) believe that standardized achievement tests provide measures of student achievement suitable for comparative standards. Unfortunately, little work has been done in developing instruments which can assess the quality of on-the-job performance. Though

far from the ultimate desired goal, some instruments are being developed.

One of the most ambitious and successful undertakings, as noted by Baldwin (1969), is the standardized testing in vocational education being conducted by the Instructional Materials Laboratory of the Ohio State University. From this research, the Ohio Trade and Industrial Education Achievement Tests (OTAT) were developed. These tests (Ohio Trade and Industrial Education Services, 1966, 1970), which originated in 1958, were developed as achievement tests for high school trade and industrial education classes. First limited to Ohio, the tests were later administered in several states.

Finch and Bjorkquist (1970), while noting the promise of standardized achievement tests, also pointed out their shortcomings. They suggested that a test constructed as the OTAT is, measures the academic component of achievement in vocational education rather than the performance aspects of the occupation. Finch and Bjorkquist go on to say that the OTAT has not been sufficiently supported by validity studies, nor have the test scores been related to actual on-the-job performance.

To date, a small amount of research has been conducted and reported by the Ohio State Instructional Materials Laboratory. A 1961 study conducted to establish predictive validity correlated OTAT machine shop and auto mechanics scores with teachers' grades. Though the correlations were .35 and .39, they were not significantly higher than the correlations between ability (measured by the California Survey of Mental Maturity, Non-Language) and OTAT scores, .34 and .39 respectively.

Two research studies were reported in the test manual, Achievement Test Program (1970, p. 27). One study conducted to evaluate teaching and learning in Ohio Trade and Industrial Education programs used the OTAT as

a criterion measure of student success. The second study noted was a pilot study developed in part to validate the Ohio Printing Achievement Test, one of the trade tests of the OTAT. By using a Job Performance Criterion Measure, the validity and reliability of the test were substantiated.

Kapes and Long (1971) explored the use of OTAT and its relationship to shop grades. They concluded that the Trade and Industrial Achievement Test section of the OTAT may validly measure the aspects of achievement which are possible to assess using a paper and pencil test, but that it measures only a small part of overall shop performance. They further concluded that the OTAT may be useful as an evaluation tool when knowledge of course content is important, but that performance tests may be more appropriate measures when other aspects of success are to be evaluated.

A study conducted in the Department of Vocational Education at The Pennsylvania State University by O'Reilly (1972) (VDS Monograph Number 6) investigated the validity of the OTAT, GPA and shop grades as success measures by relating them to many different student characteristics. O'Reilly found that GPA in both 10th and 11th grades were related to numerical aptitude and vocational maturity. Shop grades in 10th and 11th grades were both related to verbal aptitude while 11th grade OTAT was found to be related to verbal aptitude, spatial aptitude and form perception. O'Reilly concluded that:

> Because of the relationship among the success criteria, a student who is successful in terms of specific shop experiences is likely to be successful in the overall educational system. However, a specific type of success is still best measured in terms of a given criteria. For example, GPA best measures success in the overall educational system while shop grade best measures success in a specific vocational course.

Summary

Research indicates that grades have been widely used as both predictors of vocational education student success and as criteria of that success. Of the two, grades and GPA, several researchers see shop grades as being the more accurate measure of student vocational success. Although many research findings have failed to find a relation between grades and adult vocational success, the reason for this may be the methodology used rather than an actual lack of correlation. Whether grades are valid as criteria needs further research.

The Ohio Trade and Industrial Education Tests show promise as a criteria measure of student success. There is some evidence that this test battery is more reliable and has greater validity than GPA or shop grades for predicting a vocational student's mastery of occupational knowledge in a training situation.

III

PROCEDURE

Population and Sample

The sample for this study was drawn from the ninth grade student population of Altoona, Pennsylvania during the 1968-69 school year. Altoona is located in Blair County, eighty miles east of Pittsburgh, having a population of 62,900 (1970 census). This industrial city was founded by the Pennsylvania Railroad in 1849, and while the railroad shops still provide substantial employment for residents of the city, new and diversified industries now provide the major payroll. Weekly earnings for all manufacturing industries currently average $120 per employee. Unemployment rates have fluctuated seasonally, however, they have remained near the 1971 national average of five and three quarter percent. Of the city's population, 16,000 persons are five to ninteen years of age, 900 of which are enrolled in the vocational-technical high school.

All of the data for this study was collected as a part of a ten year longitudinal vocational development study conducted by the Department of Vocational Education at The Pennsylvania State University. The student sample for this study consisted of eleventh grade vocational-technical students for which the OTAT test scores, the VPI scale scores, tenth grade shop grades, and tenth grade GPA were available. Of the 157 students who took the VPI, 91 were also administered the OTAT. For maximum sample size, analysis was made from two sub-samples of the total sample. One sub-sample consisted of all shop students taking the VPI and having tenth grade shop grades and GPA available. The other sub-sample

consisted of all shop students who took the VPI and the OTAT. Not requiring all of the OTAT students to have scores on GPA and shop grades enlarged this sample from 64 to 91. Of the original 157 VPI students, some were left out of both sub-samples. Twelve students who took the VPI were not in vocational courses and, therefore, were not used in the sample. Seven other students also not included had taken the VPI but had not taken the OTAT or received a GPA or shop grade.

To have performed a separate analysis on each individual shop would have produced sample sizes too small to achieve useful results, therefore, all shops were grouped together. Table 1, however, does show the composition of the sample by individual shops.

Table 1. Number of Students in Each Vocational Program Who Had Taken the VPI and OTAT.

Shop	VPI Scores	OTAT
Appliance Repair	6	0
Automotive	16	14
Building Maintenance	2	0
Carpentry	11	7
Computer Technology	18	0
Drafting and Design	20	19
Electricity	14	14
Electronics	1	0
Machine Shop	13	13
Plumbing	8	0
Printing	5	5
Sheet Metal	13	13
Trowel Trades	5	0
Welding	6	6
Total	138	91

A further reduction in the sample would have occured had the VPI manual instructions been followed concerning "extreme" responses. According to the VPI manual the individual scale scores for a subject with extreme response bias should not, in general, be interpreted, but rather interpretation should be made of the response style being expressed. The manual describes under-responsiveness as indicative of "greater independence, passivity, depression, rejection of the culture, over-control, withdrawal, and defensiveness" (Holland, 1965, p. 3).

Olson (1971) in a study eliminated over 50 percent of his technology instructor sample due to extreme response styles on the VPI. Most of his samples were eliminated due to under-responsiveness. The reason attributed to the large number of under-responsive VPI profiles was the defensiveness of the instructors. Several factors were listed which were felt to have caused this behavior: (1) student evaluation of instructors, (2) wage negotiation, (3) accreditation proceedings, (4) a Job Description Index, and (5) a "Confidential" stamped on the questionnaire used.

Because this study used a student rather than a teacher sample, the factors Olson described were not appropriate explanations of under-responsiveness in this sample. The administration of the VPI to the vocational students was conducted such that defensive behavior which was not characteristic of the student's personality would not be produced. Even with these precautions, 49 of the 138 students (or 36 percent) were characterized as under-responsive on the VPI. Under-responsiveness on the VPI is defined as a flat profile with five or more scales having raw scores of less than three. Of the six VPI

scales used in this study, (R, I, S, C, E, A), under-responsiveness while useful as an indicator of dependency, agressiveness, mood, conservatism, impulsivity, sociability, or frankness, did not appear to invalidate the primary personality type (high point code) of a student. The high point code on the VPI profile identified a student's primary personality type just as clearly for the under-responsive students as it did for the rest of the sample. Therefore, no students were taken from the sample due to under-responsiveness.

Essential Data

Independent Variables

Vocational Preference Inventory (VPI) scores were used to form the independent variables necessary for this study. The critical raw scale scores were used to obtain the high point codes reported in question number 1 and for the correlational analysis required in question 2. Questions 3, 4 and 5 required the construction of a congruence variable using the VPI high point codes.

The VPI (Sixth Revision, 1965) is an instrument developed to assess personality types. Holland has stated that vocational interests and personality are not independent but that interest inventories are personality inventories.

> The choice of an occupation is an expressive act which reflects the person's motivation, knowledge, personality, and ability. Occupations represent a way of life, an environment rather than a set of isolated work functions or skills. To work as a carpenter means not only to use tools but also to have a certain status, community role, and a special pattern of living. In this sense, the choice of an occupational title represents several kinds of information: the s's motivation, his knowledge of the occupation in question, his insight and understanding of himself, and his abilities. In short, item responses may be thought of as limited but useful expressive or projective protocols (Holland, 1965, p. 2).

The item responses to the VPI are "like" or "dislike" answers to 160 occupational titles. The occupational titles are chosen empirically to assess eleven personality scales: Realistic, Intellectual, Social, Conventional, Enterprising, Artistic, Self-control, Masculinity, Status, Infrequency, and Acquiescence. These scales yield a range of information concerning values, attitudes, personality variables, and psychiatric status. Only the first six scales were considered useful for the purposes of this study as they determine personality type.

The VPI is easily administered, the student simply relates his preferences for occupations on an answer sheet which can be hand scored in less than 60 seconds. Testing time is 15-30 minutes depending on the individual student. Test scores can then be plotted on profiles available from the test publisher. Raw scores on the six personality scales may range from zero to fourteen, depending upon the number of occupations marked "like" on each scale.

Internal consistencies for 6,289 male college freshmen for the six personality scales ranged from .83 to .89 while for 6,143 female college freshmen they varied from .76 to .89. Retest reliabilities for a one year interval were reported by the manual to range from .61 to .86 for a mixed group of 26 college freshmen. For a four year interval reliabilities were much lower, .47 to .61 for 432 males and .45 to .56 for 204 female National Merit Finalists.

To test the validity of the VPI Holland (1962) intercorrelated the scales with several personality inventories and scales: California Psychological Inventory, Minnesota Multiphasic Personality Inventory, Sixteen Personality Factor Questionnaire, National Merit Student

Survey, and Barron's Independence of Judgement, Originality and Complex-Simplicity. "Generally, the observed relationships lend support to the construct validity and meaning attributed to the VPI scales. ...Taken together, current studies lend strong support to the meaning attributed to the VPI scales..." (Holland, 1965).

Assuming that Holland's VPI is able to identify personality types and that these personality types do have meaning, this study used the VPI to determine vocational student primary personality type. This was done by plotting a VPI profile for each student in the sample. This profile was normalized using Holland's sample of 6,270 male college freshmen. From the six personality scales, the one which plotted highest (high point code) determined that scale factor as the primary personality type.

Astin and Holland have suggested that work environments are characterized by the personalities of the people who inhabit them. The Holland classification system has been used to empirically define several common occupations (Holland et. al. 1970). All the occupations being trained for at the vocational school used in this study are classed as having Realistic environments with the exception of electronics and computer technology, which are Intellectual-Realistic.

Holland (1966b) has defined a conceptual and an empirical definition for the Realistic environment.

> Conceptual Definition. The Realistic environment is characterized by the explicit, physical, concrete tasks with which it confronts its inhabitants. Effective solutions often require mechanical ingenuity and skill, persistence, and phsyical movement from place to place, often outdoors. The Realistic environment demands only minimal interpersonal skills, because most of the tasks it sets can be accomplished by superficial and casual relationships that frequently require

> only stereotyped conversations. Tasks frequently call for simple sets of action. The explicit quality of the environmental demands make "success" and "failure" almost immediately obvious.
> Empirical Definition. The Realistic environment is populated largely by persons who have preferences for, are training for, or are employed in such occupations as airplane mechanic, construction inspector, electrician, filling station attendant, and fish and wildlife specialist. The following settings are typical of the Realistic environment: a filling station, a machine shop, a farm, a construction project, a barber shop (Holland, 1966b).

Because the majority of the occupations being trained for in the vocational school have been classified by Holland and his associates as Realistic occupations, this study chose to define all vocational training programs as Realistic. This decision also seemed appropriate in light of the conceptual and empirical definitions.

With the vocational school environment defined as Realistic and each student's primary personality type determined from the VPI, the independent variable, congruence-incongruence, was found for each subject in the sample. Very simply, any student who had a Realistic primary personality type was termed congruent, and coded "1" while any student who had a primary personality type other than Realistic was termed incongruent, and coded "0" for purposes of analysis.

Dependent Variables

Three criteria were selected to measure student in-school success. These criteria were suggested by O'Reilly in a previous Vocational Development Study monograph (VDS Monograph Number 6, Evaluation of In-School Success Criteria for Vocational-Technical Students). O'Reilly noted that educational success is often measured by grade point average (GPA), particular class grades, and standardized test scores. He has

constructed a figure (VDS Monograph Number 6, p. 4) showing the relationships between each of the three measures of success, GPA, shop grade, and OTAT, and also their relationship to success in later life.

1. GPA. The most general indicator of in-school success used was overall grade point average (GPA). GPA is widely used in school systems as a measure of in-school success and, because in-school success is a factor in later vocational success, GPA has been included as a criterion variable.

The method used to arrive at GPA for this study needs explanation. An earlier Vocational Development Study (Kapes, 1971, Monograph Number 2, pp. 77-79) developed a method for determining vocational students' GPA. Essentially what was done was to weight the vocational course grade in terms of course hours before averaging all of a student's grades together. Therefore, because approximately half of the vocational students' day was spent in a vocational class, half of his GPA was composed of that grade. The other half of the GPA was an average of the remaining full credit courses a student took in his high school curriculum. Kapes has shown that this type of GPA was more appropriate than either shop grades or non-vocational subject grades alone.

One additional factor used in determining the GPA was a weighting placed on certain subjects by the Altoona school system. This factor gave an additional 20 percent weight to three advanced courses which might have been taken, geometry, chemistry, and a third year of a foreign language. Thus, a grade of "C" in an advanced course would have a grade point of 3.6 rather than 3.0, a "B" would be 4.8 rather than 4.0 and so forth. The total range of GPA, therefore, was from 1.0

to 6.0. The GPA collected for use in this study consisted of the student's tenth grade grades.

2. Shop Grades. It is possible that for vocational students shop grades may be a more appropriate criterion than overall GPA; therefore, shop grades were also collected at the end of the tenth grade for use in this study. No weighting of any kind is used in recording these grades. An "A", "B" or "C", therefore, is assumed to be the same in any shop course. Shop grades ranged from "A" (5.0) to "F" (1.0).

3. The Ohio Trade and Industrial Education Achievement Test. The third variable chosen as an assessment of student achievement was the Ohio Trade and Industrial Education Achievement Test (OTAT). This test battery grew from the demands of vocational educators for an instrument to measure success in trade areas. The test battery embodies the California Survey of Mental Maturity, Advanced; The Stanford Achievement Test, Advanced Arithmetic Test-Form JM; and selected trade tests. These basic trade tests cover the areas of machine trades, automotive mechanics, basic electricity, basic electronics, mechanical drafting, printing, sheet metal, cosmetology, auto body, welding, carpentry, and dental assisting.

Though the test battery includes a measure of mental maturity, an arithmetic achievement test, and an intelligence quotient, only course achievement as measured by the individual trade tests were used as achievement criterion in this study.

With the exception of the electricity and electronics achievement tests, the trade tests are divided into two parts to be administered on consecutive days. This is necessitated because of the time needed, up to six hours for some occupational areas, to complete both parts.

Each test is made up of sub-tests, varying in number from eight to eighteen; each sub-test covers a specific area of that trade.

Since the number of test items as well as the number of sub-tests varied from one trade to another, the OTAT scores were standardized for this study. This enabled all the trade areas to be grouped together. The standard scores had a mean of 500 and a standard deviation of 100. This conversion method has been used previously by Enderlein (VDS Monograph Number 4) and O'Reilly (VDS Monograph Number 6) in their studies involving the OTAT.

Limited validity studies have been made on the OTAT trade tests. Content validity was established by the test developers and construct validity was determined by test battery intercorrelations. Predictive validities were conducted for the machine trade and automotive mechanics tests, with correlations of .35 and .39 between test scores and teachers' grades. Reliability coefficients (Kuder-Richardson 20) ranged from .83 to .95 for the total trade test scores.

Analysis

The data for this study were analyzed using three statistical methods--the Pearson Product Moment Correlation, Bartlett's Test for Homogeneity of Variance, and a Pooled Variance T-Test.

The Pearson Product Moment correlation was used to test the relationship between each variable and all of the other variables. These variables were the six VPI scales, GPA, shop grades, and OTAT.

Bartlett's Test for Homogenity of Variance was used with the two sample groups, congruent students and incongruent students, to determine that they had essentially the same variance on the criterion variable.

This was done for each of the dependent variables, GPA, shop grades, and OTAT.

A pooled variance t-test was used to determine whether the two groups, congruent and incongruent differed in respect to the three dependent variables, GPA, shop grade, and OTAT.

IV

FINDINGS

Introduction

This chapter will present the findings of this study. These findings are shown in Tables 2, 3 and 4 and are described as they relate to each question posed in Chapter I. Conclusions concerning the data are discussed in Chapter V.

Question #1

What proportion of vocational-technical students are congruent with their training environment?

The VPI was administered to 157 students in the Altoona Vocational-Technical High School, 139 of which were used in this research. Of this group, 78, or 57 percent, were found to be congruent. Since all of these students were in an environment defined as Realistic, being congruent meant that each of these students' primary personality type was Realistic. The other 60 students, 43 percent, were incongruent (i.e., had other than a Realistic primary personality type). These students exhibited one of the five other personality types as their VPI primary personality type. The number and percentage of students in each category are shown in Table 2.

Question #2

What is the relationship between students' scores on each of the VPI scales and each of the three dependent variables, GPA, shop grade, and OTAT score?

Table 2. Primary Personality Types of 138 Vocational-Technical High School Students.

Primary Personality Type	Number of Students	Percentage
Realistic	78	56.5
Intellectual	11	8.0
Social	5	3.6
Conventional	13	9.4
Enterprising	14	10.1
Artistic	17	12.3
Total	138	99.9

Note: Percentages do not equal 100.0 because of rounding

To answer question number two, Pearson Product-Moment Correlations were computed between all the independent variables and the three dependent variables. The correlations between the predictor variables (the six VPI personality scales) and the three criterion variables (GPA, shop grade, and OTAT scores) are shown in Table 3. The correlations ranged from -.15 to .18 with only the correlation between the Intellectual scale and GPA being significant at the .05 level.

Table 3 also shows the intercorrelations among the six predictor variables. Although the six scales were designed by Holland to be independent, they are significantly related to each other at the .01 level. The most highly related scales in this study were the Conventional and Enterprising scales. The correlation between these scales of .69 indicates a shared variance of .48. To Holland this would indicate enough difference between scales to justify their use.

The intercorrelations among the three criterion variables, GPA, shop grade, and OTAT are also presented in Table 3. The correlation between shop grades and OTAT scores is significant at the .05 level while the correlation between GPA and OTAT scores is significant at the .01 level. The correlation between GPA and shop grades is significant beyond the .01 level, but it must be noted that shop grade composed 50 percent of the GPA used in this study.

Question #3

Does congruence between personality type and environmental type result in greater achievement of vocational-technical students as measured by grade point average (GPA)?

Table 3. Zero-Order Correlations Among the Six VPI Independent Variables and the Three Dependent Variables (n = 123)[a]

	Variables	Intercorrelations of Predictors[b]					Criteria and Predictors		
		Int	Soc	Con	Ent	Art	GPA	Shop Grades	OTAT[a]
1.	Realistic	.42	.53	.41	.47	.26	.04	.11	-.06
2.	Intellectual		.48	.52	.45	.39	.18*	.09	-.07
3.	Social			.58	.65	.52	.01	.02	-.10
4.	Conventional				.69	.43	.13	.11	-.10
5.	Enterprising					.47	.13	.12	-.09
6.	Artistic						.01	.08	-.15
							Intercorrelation of Criteria		
7.	GPA							.88**	.39**
8.	Shop Grades								.21*
9.	OTAT[a]								

[a] for OTAT variable sample size = 76

[b] all Predictor intercorrelations are significant beyond the .01 level.

* significant at .05

** significant at .01

This question was answered by applying a pooled variance t-test to the sample of students with grade point average data. Table 4 presents the results of the analysis. The mean GPA of the congruent and incongruent students are essentially the same, 3.00 and 3.06, however, the variances for the two groups do differ, .6454 and .8814. Using the Bartlett's Test for Homogeneity of Variance, a chi-square with one degree of freedom was found to be 5.7943. This value is significant at the .05 level indicating that the differences in variances may not be due merely to sampling fluctuations. However, since the sample size is large and the two groups approximately equal, it would be appropriate to use the t-test for analysis. When this was done a student t value of .4539 was computed. This value was considerably less than the 1.98 value necessary to show a significant difference between the two groups, congruent and incongruent at the .05 level.

The data from Table 4 indicates that vocational-technical students whose personality type and environmental type are congruent do not achieve a higher GPA than those who are incongruent.

Question #4

Does congruence between personality type and environmental type result in greater achievement of vocational-technical students as measured by shop grades?

The same methods of analysis used to answer question number 3 were used to answer question number 4. The test for homogeneity of variance produced a chi-square value of 1.3648 with one degree of freedom. This was not significant at the .05 level. The difference in variances, between the congruent student shop grades and the incongruent student

Table 4. Means, Standard Deviations and Pooled Variance T-Test for the Dependent Variables, GPA, Shop Grades, and OTAT

Criterion	Consistent			Inconsistent		"Student t"
	n	Mean	SD	Mean	SD	
GPA	123	3.00	.6454	3.06	.8814	.4539
Shop Grades	123	3.32	.8597	3.26	.9998	.3605
OTAT	91	500.80	106.21	482.29	98.92	.8307

Note: All three "student t" values were not significant at the .05 level.

shop grades (.8597 and .9998 shown in Table 4) appear to occur due to sampling fluctuation. The means for the two groups appear to be similar; 3.32 and 3.26. The student t value of .3605 was not larger than the 1.98 value required for significance at the .05 level. It cannot be assumed that a true difference exists between the means of congruent and incongruent groups.

The data indicate that congruent vocational-technical students do not achieve more than incongruent vocational-technical students when achievement is measured by shop grades.

Question #5

Does congruence between personality type and environmental type result in greater achievement of vocational-technical students as measured by The Ohio Trade and Industrial Education Achievement Tests (OTAT)?

This question again uses the techniques of analysis used in question numbers 3 and 4. The results are tabulated in Table 4. The means for OTAT congruent and incongruent groups were 500.80 and 482.29. The test for homogeneity of variance established a chi-square value of .2072 with one degree of freedom. The probability of exceeding this chi-square value by chance, assuming equal variance, was .64, indicating that the difference between the standard deviations of the congruent and incongruent groups (106.21 and 98.92) would have occurred by chance nearly two out of three times. The congruent students exhibited a higher mean OTAT score, however, the student-t of .8307 was not significant at the .05 level, thus no true difference in means can be assumed.

Interpreting the data from Table 4 answers question number 5. Congruent vocational-technical students do not achieve more than incongruent vocational-technical students when achievement is measured by The Ohio Trade and Industrial Education Achievement Tests.

V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Chapter V provides a summary of this study, conclusions based on the findings, implications for vocational educators, and recommendations for further study.

Summary

Introduction

The "extra cost" factor of vocational education makes it imperative that more efficient methods be used to reach the objectives of vocational education programs. One way in which efficiency in vocational and practical arts curriculums may be increased, helping both programs and students, is to increase the percentage of students who successfully complete a vocational training program and become successful in the occupation for which they have prepared. Holland has proposed a theory of vocational choice which, when applied to vocational students, may facilitate a greater number of successful vocational choices. Better directed and more knowledgeable students who make fewer changes in their choice of occupation would lead to an overall increase in efficiency in vocational and practical arts curriculums, thus reducing the "extra cost" factor of such education and making it an economical educational alternative.

Statement of the Problem

This study tested a portion of Holland's theory with eleventh grade vocational students. Holland's concept of congruence-incongruence was related to success factors of vocational students. The specific

questions this study sought to answer are as follows:

1. What proportion of vocational-technical students are congruent with their training environment (i.e., Realistic)?
2. What is the relationship between students' scores on each of the VPI scales and each of the three dependent variables, GPA, shop grades, and OTAT scores?
3. Does congruence between personality type and environmental type result in greater achievement of vocational-technical students as measured by grade point average (GPA)?
4. Does congruence between personality type and environmental type result in greater achievement of vocational-technical students as measured by shop grades?
5. Does congruence between personality type and environmental type result in greater achievement of vocational-technical students as measured by the Ohio Trade and Industrial Education Achievement Tests (OTAT)?

Procedure

The sample utilized in this study consisted of 138 eleventh grade male vocational students. The data used was collected during the 1969-70 and 1970-71 school years. Tenth year GPA and shop grades were obtained at the end of the 1969-70 school year. The Ohio Trade and Industrial Education Achievement Test (OTAT) was administered in March, 1971 and the Vocational Preference Inventory (VPI) was administered in April, 1971. All data used in this study were gathered as a part of a longitudinal study of vocational development being conducted by the Department of Vocational Education at The Pennsylvania State University in cooperation with the Pennsylvania Research Coordinating Unit.

The independent variables used in this study were obtained from the students' personality types as measured by the VPI. Questions 1 and 2 examined the proportion of each type in the vocational-technical training environment and the relationship between types and in-school success. Questions 3, 4 and 5 examined the relationship between congruence-incongruence and in-school success. Congruence was established by drawing information from student VPI scores and relating that to the training environment of the vocational-technical school. A review of the literature supported the classification of the vocational-technical school curriculums as Realistic environments. Students whose VPI indicated their primary personality type to be Realistic were, therefore, coded "congruent" while all other primary personality types were coded "incongruent" for the purposes of this study.

Three dependent variables were suggested for use by O'Reilly in a previous Vocational Development Study monograph (VDS Monograph Number 6, Evaluation of In-School Success Criteria for Vocational Technical Students). These variables are grade point average (GPA), shop grades, and the Ohio Trade and Industrial Education Achievement Test scores (OTAT).

Analysis of question number one required simple numerical proportions to be calculated. The remaining questions were analyzed using two different statistical methodologies. Question 2 was answered through the use of the Pearson Product-Moment Correlations. Questions 3, 4 and 5 utilized the Pooled Variance t-Test technique.

Findings

Fifty-seven percent of the sample were categorized as having congruent personality types for the training environment they were enrolled

in (Realistic personality type in Realistic environment). The remaining forty-three percent were categorized as incongruent, since they possessed Intellectual, Social, Conventional, Enterprising, or Artistic personality types in the Realistic training environment.

Pearson Product-Moment Correlations between the six predictor variables (VPI personality scales) and the three criterion variables (GPA, shop grades, and OTAT) ranged from -.15 to .18. Only one relationship was significant at the .05 level. The intercorrelations between predictor variables ranged from .27 to .69, all showing significance at the .01 level. Intercorrelation between the criteria variables, GPA, shop grades, and OTAT were significant at the .05 level or above.

Pooled variance t-tests were used to determine whether congruent and incongruent students differed in terms of GPA, shop grade, and OTAT scores. The "t" statistics of .4539, .3605, and .8307 were found not to be significant at the .05 level.

Conclusions

Question #1

This question is concerned with finding the proportion of vocational-technical students who have personality types congruent with their educational training environment. By examining Table 2 it was found that slightly over half of the students sampled were congruent (57 percent). The table also indicates that a large number of students were incongruent with their environment (a total of 43 percent) because their primary personality type differed from their environmental type. This finding suggests that a large number of vocational students are enrolled in curriculums which are incompatible when viewed by the Holland typology. It is interesting to note, however, that of the six personality

types in the Realistic training environment, students with Realistic personality types occur more than four and one-half times as frequently as do the second most populated personality type (i.e., Artistic) and more than fifteen and one-half times as frequently as the least populated personality type (i.e., Social). On the basis of this finding, it is clear that in some manner, personality type is being matched to environmental type. Holland's hypothesis that people tend to choose an environment consistent with their personality type is supported by this finding.

Question #2

This question investigated the relationship between students' scores on the six VPI scales (predictors) and the three criteria, GPA, shop grade, and OTAT score. The correlations between the six VPI variables (Realistic, Intellectual, Social, Conventional, Enterprising, and Artistic) and the criterion variable GPA, ranged from .01 to .18. The only correlation significant above .05 was the .18 correlation between the Intellectual scale and GPA. The indication of a slight relation between GPA, representing the success in all shop and academic areas, and a personality type prone to intellectual pursuits makes intuitive sense. The more academically interested a student the more likely he is to succeed in academic subjects. The reader is reminded that GPA, in this study, was composed of fifty percent shop grade and fifty percent academic subjects. None of the other five VPI scales were significantly correlated with GPA. Having a higher score on the VPI Realistic, Social, Conventional, Enterprising or Artistic scale was not related to a higher GPA.

The correlations between the six VPI scale variables and shop grades or OTAT scores were all non-significant at the .05 level. Higher shop

grades or OTAT scores were not related to higher VPI variable scores, and Table 3 demonstrates this fact. It might be reasoned that since the Intellectual scale did predict GPA, it should likewise predict shop grades and OTAT scores. From Table 3 the intercorrelation between the criteria GPA and shop grades yield a shared variance of 77 percent. Kapes and Long (1971) have noted that other factors in addition to knowledge of course content affect shop grades. The 33 percent variance which shop grade does not share with GPA apparently was a strong enough factor to prevent the Intellectual scale score from being related to shop grades or OTAT scores.

The fact that the Realistic scale was no more related to the criteria than any other scale cast some doubt on the importance of personality type for success in the vocational training situation.

Question #3

Question number 3 asks whether congruence between personality type and environmental type result in greater achievement of vocational-technical students when grade point average (GPA) is used as the criterion. Applying a pooled variance t-test to the congruent and incongruent student groups failed to produce a t-statistic significant at the .05 level. It cannot be said that the congruent students' achievement differed from the incongruent students' when GPA was the criterion. This finding disagrees with previous research supporting Holland's theory (Werner, 1971) which found congruent students in general to have higher mean achievement than incongruent students. There are no obvious reasons why this study does not support Werner's findings. One possible explanation lies in the size of the sample. Only 138 students were available, 78 with Realistic personality types and 60 with other

personality types. Another possible reason is the number of Intellectual personality types. Observation of Table 2 demonstrates that eight percent (or 11 out of 138) of the students had Intellectual primary personality types. Since there was a positive correlation (Table 3) between the Intellectual VPI scale and GPA, it seems plausible that this could have offset the effects of congruence on GPA. A third explanation is that the classification of all the vocational shops sampled in this study as Realistic environments may not be appropriate. The Werner study selected shops which appeared to exhibit different environmental types. It may well be that different shops differ in environmental type or that the same shop may represent a different environment in different geographical areas or in diversely oriented communities.

Question #4

This question was concerned with the difference in achievement between congruent and incongruent students when that achievement was measured by shop grades. Analysis was conducted similar to that in Question 3 with the substitution of shop grades as criterion for the previously used GPA. The t-statistic calculated was .3605, not significant at the .05 level. From this analysis, it cannot be said that congruent students differ from incongruent students in achievement as measured by shop grades. No explanation beyond that offered previously in Question 3 is offered.

Question #5

Question number 5 asked whether congruence between personality type and environmental type results in greater achievement of vocational students as measured by the Ohio Trade and Industrial Education Achieve-

ment Tests (OTAT). Analysis was again conducted using the pooled variance t-test. The t-statistic computed was .83--a slightly higher figure than found with the previous criterion measures. It, however, was not significant, therefore, the null hypothesis was retained. There was no demonstrable association between congruence of vocational-technical students and greater achievement as measured by the Ohio Trade and Industrial Education Achievement Tests. No explanation beyond that offered in Question 3 can be given.

General Conclusions

The data in this study does not support the idea that Holland's theory of congruence-incongruence is applicable to vocational high school students. It would not be reasonable to make any changes in vocational curriculum objectives or methods of student selection based on the Holland theory of congruence. What this study does suggest is the possibility of using the VPI to verify vocational students' personality types. Since the VPI is an inexpensive, easily administered instrument that is not time consuming, it could be used as a counseling aid for students. Through verbal exchange between counselor and student, the student could be made aware of his relationship to personality types and environmental types. Vocational subject areas could also be evaluated for type. If shop areas were evaluated for type rather than assuming them to be Realistic, there is a possibility that Holland's congruency theory would apply.

Recommendations

In view of the findings and conclusions of this study, the following recommendations are made:

1. A study of similar intent should be conducted to further test the Holland construct of congruence-incongruence using a larger sample of vocational-technical students.
2. A study patterned after this one would benefit by evaluating each vocational-technical area in terms of personality type. In this study electronics technology students classified as being congruent with an Intellectual rather than a Realistic environment could be more appropriate. Other shops might likewise be reclassified in a future study.
3. An investigation of other possibly more meaningful measures of achievement should be made, and compared to vocational success on the job to find the most appropriate criteria for use in high school counseling.
4. The Holland typology should be looked at in terms of its other possible benefits to the vocational-technical student. Such benefits as personality identification and environmental classification may be more helpful than the prediction of success.
5. The Holland theory of congruence-incongruence needs to be pursued longitudinally with a sample of vocational-technical students to determine whether personality type is stable in an individual or whether it may be changed to adapt to an environment.

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